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## Safety device for a motor vehicle

- 5 The invention relates to a safety device for a motor vehicle comprising at least one closable opening of the interior according to the precharacterizing clause of Patent Claim 1.
- 10 DE 40 31 552 A1 discloses a safety device for a vehicle, the interior of which has at least one opening, for example a side window, which can be closed or opened, according to choice, by a closing element coupled to a servo drive. A sensor system senses the 15 vehicle deceleration in the traveling direction and, if a default value for the vehicle deceleration is exceeded, initiates the closing movement of the closing element. Given suitable selection of the default value for the vehicle deceleration, the opening can already 20 be closed before the motor vehicle hits an obstacle. If an accident actually occurs, the occupants of the vehicle are protected from injuries caused by foreign bodies entering the vehicle from the outside through the opening. It is similarly possible to avoid 25 occupants of the vehicle being thrown out through the opening.

DE 101 21 386 C1 describes a method for activating a reversible occupant protection means in a motor vehicle 30 with a sensor system sensing driving state data.

Instances of emergency braking, oversteering and understeering of the motor vehicle are monitored as driving state data. On the basis of such a state, the 35 occupant protection means is triggered. The driving state data can also be used to determine the direction from which the greatest danger is to be expected. The occupant protection means is activated in such a way

that the protective effect is provided in accordance with the direction of greatest danger.

Furthermore, DE 44 11 184 C2 discloses a restraining belt system for a seat in a vehicle, comprising a seat belt and a belt tensioner for securing a passenger on the seat. The device determines the distance from an object and the corresponding relative velocity. This can be used to determine the expected time to a possible collision between the vehicle and the object. A control unit generates a control signal, which increases the force of the belt tensioner at an appropriate time before the possible collision. If a collision can be avoided, the force of the belt tensioner is reduced again. The controllable belt tensioner is configured as a pretensioner, which before the collision is active only up to a predetermined pretension, a further belt tensioner being triggered for tighter tensioning of the seat belt if the collision is actually found to have occurred.

The invention is therefore based on the object of providing a safety device for a motor vehicle comprising at least one closable opening of the interior, a closing element driven by a servo drive being provided for closing the opening, which device has improved occupant protection in comparison with the safety devices that are known from the prior art.

The stated object is achieved by a safety device for a motor vehicle comprising at least one closable opening of the interior with the features of Patent Claim 1.

According to the invention, the control unit evaluates the data relevant to safety when the vehicle is in motion and activates the servo drive at such a time that the closing element for closing the opening is moved into the predetermined position, in which the closable opening has an open gap, prior to the

occurrence of an expected accident. The safety device for the motor vehicle comprises at least one closable opening of the interior of the motor vehicle, the closing element that is driven by the servo drive being  
5 provided for closing the opening, and the control unit. The safety device according to the invention ensures that, in the event of an accident occurring, adequate oxygen is supplied and made available to the occupants of the motor vehicle. In the event of an accident,  
10 there may be high levels of contamination from gas or soot particles, for example as a result of pyrotechnic occupant protection means being triggered, representing a high degree of risk to the health of the occupants.  
15 The opening, left open by a gap, for example a side window, allows the gas or soot particles to escape from the interior of the motor vehicle into the surroundings and at the same time allows oxygen to be supplied from the outside to the occupants in the interior. In this case, it is of advantage that the closing element can  
20 be moved into the predetermined position both from an open position and from the closed position. The predetermined position for the closing element is already reached before the occurrence of the actual accident, thereby achieving additional safety for the  
25 occupants.

Movement of the closing element into the predetermined position while the accident is actually in progress could no longer occur under some circumstances, on  
30 account of failure of the voltage supply. The time immediately before the accident is used to initiate precautionary measures to improve occupant safety. The safety device acting with a preventive effect ensures preventive occupation protection.

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The closing element may be any automatically closable component of the motor vehicle, for example a windowpane or a sliding roof.

The data relevant to safety when the vehicle is in motion may be, in particular, driving state variables. Variables such as vehicle speed, yaw, longitudinal and lateral accelerations, brake pedal and gas pedal positions and the steering angle may be used as driving state variables. Furthermore, the status of operating elements such as turn indicators and hazard warning lights as well as the status of sensors and control devices concerning the motor vehicle may also be used.

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As an alternative or in addition, the data relevant to safety when the vehicle is in motion may be ambient data. Ambient data is the term used to refer to data provided by ambient sensors, telematic systems and communication of the motor vehicle with other motor vehicles and stationary communication systems. Examples of ambient data are information on the current location, on the category of road and on the lane in which one's own motor vehicle is driving. Other ambient data include the state of the road, temperature, weather, light conditions and the speed, distance, type and size of motor vehicles and other road users ahead, alongside, following or oncoming.

It is of advantage if the data relevant to safety when the vehicle is in motion are evaluated driver activities. Sensing driver activity comprises, for example, detecting eye movement and viewing direction, but also operating actions on operating elements, such as for example the steering wheel, gear selector lever and brake pedal. By evaluating a plethora of safety-relevant data it is possible if need be for the correct point in time for closing the tilting roof to be determined by means of the control unit.

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Further advantageous refinements of the invention are provided in the subclaims.

The invention is explained in more detail on the basis of an exemplary embodiment in the single figure, the figure showing a detail of a safety device for a motor vehicle comprising at least one closable opening of the interior in a block diagram.

According to the figure, a safety device 1 for a motor vehicle comprises a closable opening of the interior 2 of the motor vehicle, a closing element 4 driven by a servo drive 3 being provided for closing the opening.

A control unit 5 evaluates the data 6 relevant to safety when the vehicle is in motion and activates the servo drive 3 at such a time that the closing element 4 is moved into a predetermined position, in which the closable opening has an open gap, prior to the occurrence of an expected accident. The closing element 4 can be moved into the predetermined position both from an open position and from the closed position. The closing element 4 may be configured, for example, as a side window or as a sliding roof of the motor vehicle.

The servo drive 3 may additionally have a quick closing function, which is activated when the servo drive 3 is activated by the control unit 5. The quick closing function of the servo drive 3 ensures that the closing element 4 has reached its end position with the open gap at an appropriate time before the occurrence of the actual accident. The quick closing function may also be realized in a separate servo drive 3. If the accident does not occur, the closing element 4 is returned again to its starting position.

The size of the gap can be individually preset, depending on the configuration of the closing element 4. The presetting may take place at the factory or be performed by an occupant of the motor vehicle.

The safety device 1 may also activate a number of closing elements 4, for example a number of side windows of the motor vehicle. The activation of the side windows may take place in various operating modes.

5 In a first operating mode, all the side windows can be moved into a predetermined position at the same time. In a second operating mode, only the windows that are next to an occupant are activated. Occupant sensing may be carried out by means of a seat occupancy 10 detection. Other operating modes for the safety device 1 are also conceivable, however.

The data 6 relevant to safety when the vehicle is in motion are driving state variables, ambient data and/or 15 evaluated driver activities.

The safety device 1 according to the invention for the motor vehicle comprising the closable opening of the interior 2 ensures a secured supply of oxygen to the 20 occupants of the motor vehicle during and after an accident. The safety device 1 can be realized with little expenditure, since the main components of the safety device 1 are generally already integrated in the motor vehicles as standard.